Seal-less Pump Technology

Oil and Gas
Robust design - Reliability
Hydra-Cell® Oil & Gas Industry Pumps - High reliability,

Gas Extraction
- Produced water injection
- Produced water disposal
- Well dewatering
- NGL transfer
- Polymer injection

Gas Processing
- Gas drying
- Sweetening
- Odourising

Artificial Lift – Jet Pumps
- Power fluid pressurisation

Pressure Testing
- Pipes and well testing
Hydra-cell® oil & gas industry pumps - compact, seal-less and energy efficient design

**Oil Refining**
- Steam stripping / generation
- Additive injection
- Stack cooling
- Chemical metering
- High pressure cleaning
- Chemical transfer
- Burner Fuel Feed
- Emissions Control
- Solvent transfer
- Process sampling
- Seal flushing
- Water treatment

**Onshore / Offshore Oil Extraction**
- Well stimulation
- Produced eater injection
- Produced eater disposal
- Chemical injection
- Methanol injection
- Polymer Injection
- Drilling mud injection
- Crude oil transfer and sampling
- Injection of drag reducing agents
- Reverse osmosis & filtration
- High pressure cleaning
- Polymer Injection

**Distribution**
- Gasoline transfer
With over 35 years experience in Oil and Gas industry service, Hydra-Cell® pumps have proven performance. In 2010, the new Hydra-Cell® T-Series packing free triplex pump received a “Spotlight on New Technology” award from the Offshore Technology Conference (OTC).

- Production
- Transport
- Refining

<table>
<thead>
<tr>
<th>Well Injection Metering and Dosing Chemicals</th>
<th>Challenges in Pumping</th>
<th>The Hydra-Cell® Advantage</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acids</strong>… Sulphuric, Hydrochloric, Nitric</td>
<td>• Corrosive.</td>
<td>• No dynamic seals to be damaged.</td>
</tr>
<tr>
<td></td>
<td>• Tend to crystallise when cold or in contact with air, forming fine solids which can damage mechanical seals.</td>
<td>• Unique spring-loaded check valves, which can handle liquids with particles reliably.</td>
</tr>
<tr>
<td><strong>Biocide Injection</strong></td>
<td>• Very low flow rates, accurate metering of chemicals to optimise usage, minimise environmental damage.</td>
<td>• Unique multiple diaphragm pump head providing virtually pulseless flow for accurate metering.</td>
</tr>
<tr>
<td><strong>Caustics</strong>… Sodium Hydroxide, Potassium Hydroxide</td>
<td>• Tend to crystallise when cold or in contact with air, forming fine solids which can damage mechanical seals.</td>
<td>• Seal-less pump head means that liquids containing particles can be pumped reliably.</td>
</tr>
<tr>
<td><strong>Corrosion Inhibitor</strong></td>
<td>• Very low flow rates, accurate metering of chemicals to optimise usage, minimise environmental damage.</td>
<td>• Unique multiple diaphragm pump head providing virtually pulseless flow for accurate metering.</td>
</tr>
<tr>
<td><strong>Demulsifier</strong></td>
<td>• Very low flow rates, accurate metering of chemicals to optimise usage, minimise environmental damage.</td>
<td>• Unique multiple diaphragm pump head providing virtually pulseless flow for accurate metering.</td>
</tr>
<tr>
<td><strong>H2S Scavengers</strong> Amines</td>
<td>• Containment of any H2S saturated in Amine.</td>
<td>• Seal-less pump chamber provides 100% containment.</td>
</tr>
<tr>
<td></td>
<td>• Responsive accurate control of flow rate.</td>
<td>• Virtually pulse-less flow gives responsive control with accuracy exceeding API 675 performance criteria.</td>
</tr>
<tr>
<td><strong>O2 Scavengers</strong></td>
<td>• Tend to crystallise when cold or in contact with air, forming fine solids which can damage mechanical seals.</td>
<td>• Unique spring-loaded check valves, which can handle liquids with particles reliably.</td>
</tr>
<tr>
<td><strong>Scale Inhibitor</strong></td>
<td>• Corrosive.</td>
<td>• No dynamic seals to be damaged.</td>
</tr>
<tr>
<td><strong>Sodium Hypochlorite</strong></td>
<td>• Outgassing.</td>
<td>• Correct pump selection to achieve higher speed, giving the ability to clear gas quicker.</td>
</tr>
<tr>
<td>Typical Chemicals and Liquids Pumped</td>
<td>Challenges in Pumping</td>
<td>The Hydra-Cell® Advantage</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Condensates</td>
<td>• Non-lubricating.</td>
<td>• No need for lubrication from pumped liquid.</td>
</tr>
<tr>
<td></td>
<td>• Must be 100% contained to comply with VOC emissions legislation.</td>
<td>• Seal-less pump chamber provides 100% containment.</td>
</tr>
<tr>
<td>Crude Oil</td>
<td>• Range of viscosities makes it difficult to pump.</td>
<td>• Hydra-Cell® seal-less pumping action can handle liquids with viscosities from 0.01 to 6000 cSt, or liquids containing a mixture of viscosities.</td>
</tr>
<tr>
<td>Drag Reducing Agents</td>
<td>• Very abrasive and highly viscous.</td>
<td>• No dynamic seals to be damaged by abrasive product</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Can handle high viscosity liquids.</td>
</tr>
<tr>
<td>Hot Tri-Ethylene Glycol (TEG) and Diethylene Glycol (DEG)… for gas drying</td>
<td>• Non-lubricating.</td>
<td>• No need for lubrication from pumped liquid.</td>
</tr>
<tr>
<td></td>
<td>• Liquid temperatures up to 100˚C.</td>
<td>• No dynamic seals to be damaged.</td>
</tr>
<tr>
<td></td>
<td>• Controllability of injected TEG /DEG.</td>
<td>• Flow rate directly proportional to pump rpm.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• RPM adjustable range from 10 rpm to 1500 rpm (1000 rpm for some models).</td>
</tr>
<tr>
<td>Methanol… for well icing prevention</td>
<td>• Non-lubricating, especially pumping at pressure.</td>
<td>• No need for lubrication from pumped liquid.</td>
</tr>
<tr>
<td>Natural Gas Liquids… for well stimulation</td>
<td>• Non-lubricating.</td>
<td>• No need for lubrication from pumped liquid.</td>
</tr>
<tr>
<td>Mixtures of Methane, Propane, Ethane</td>
<td>• Must be 100% contained to comply with VOC emissions legislation.</td>
<td>• Seal-less pump chamber provides 100% containment.</td>
</tr>
<tr>
<td>Polymers… for well stimulation</td>
<td>• Shear sensitive gel structures which can be broken down easily.</td>
<td>• Low shear pumping action.</td>
</tr>
<tr>
<td></td>
<td>• High viscosity.</td>
<td>• Unique spring loaded check valves for reliable pumping action.</td>
</tr>
<tr>
<td></td>
<td>• Abrasive, contains soda ash.</td>
<td>• Seal-less pump chamber and unique spring loaded check valves allows reliable pumping of liquids with suspended solids.</td>
</tr>
<tr>
<td></td>
<td>• Responsive accurate control of flow rate.</td>
<td>• Virtually pulseless flow gives responsive control with accuracy exceeding API 675 performance criteria.</td>
</tr>
<tr>
<td>Produced, Salt and Sour Water injection, disposal and transfer</td>
<td>• Corrosive. Can contain H2S, salt, CO2 plus other impurities forming acidic solutions.</td>
<td>• Corrosion resistant liquid head materials available</td>
</tr>
<tr>
<td></td>
<td>• Abrasive. Water contains sand and other contaminants… barium, cadmium, sulphur, chromium, copper, iron, lead, nickel, silver and zinc.</td>
<td>• Seal-less pumping chamber</td>
</tr>
<tr>
<td></td>
<td>• Containment of H2S gas.</td>
<td>• Seal-less pump head means that liquids containing particles can be pumped reliably.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No dynamic seals to wear.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• No cups, packing or seals to leak gas</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Seal-less pump chamber provides 100% containment.</td>
</tr>
</tbody>
</table>
Designed for continuous use, Hydra-Cell® Seal-less Pumps are robust, reliable, efficient and can be used in a wide variety of Oil and Gas applications, lowering the total cost of ownership.

**Hydra-Cell® advantages**

**High reliability... low maintenance**

Having **No Dynamic Seals** means high reliability.

- Run dry indefinitely
- No seals to wear
- No seals to leak any potentially harmful gases such as H₂S
- No seals to leak any Volatile Organic Compounds
- No tight tolerances that could be susceptible to corrosion or damaged by solid particles
- Pumps liquids with viscosities from 0.01 to 6000 cSt
- Pumps non-lubricating liquids reliably
- Pumps liquids with up to 500µm dia. particulate matter
- No ‘drop-off’ in performance due to seal wear

**Hydra-Cell® pumps have no packing**

**Compact design**

For metering and dosing applications Hydra-Cell®’s compact design gives real advantages.

1. Space saving
2. Easier servicing
3. Lower initial purchase cost

Both pumps are rated at 172 Bar and 110 l/hr

**High efficiencies**

- A true positive-displacement pump, Hydra-Cell® is one of the most efficient metering and dosing pumps available.

Both pumps are rated at 172 Bar and 110 l/hr

**Hydra-Cell® metering pump**

Motor 0.75 kW (€60)

**Traditional Metering pump**

Motor 4 kW (€180)

**Save up to 65% on motor costs**

Hydra-Cell® multiple diaphragm head means smaller motors can be used, saving energy.
Unique spring-loaded check valves
- Reliably pump acids and caustics which crystallise.
- Efficient pumping of liquids with solids such as lime slurries, soured water containing sand.

Low shear pumping action
Due to the gentle pumping action, shear sensitive liquids, especially polymers, can be pumped without breaking down the long chain structures within the liquids.

Energy saving
- Very economical to run compared with centrifugal pumps.
- Smaller, more compact motors required.

Compared with multi-stage centrifugal pumping water at 20 bar:

<table>
<thead>
<tr>
<th>Flow (m³/hr)</th>
<th>Energy used (kw)</th>
<th>Energy saving</th>
<th>Potential annual euro saving</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Centrifugal</td>
<td>Hydra-Cell</td>
<td></td>
</tr>
<tr>
<td>0.6</td>
<td>1.54</td>
<td>0.5</td>
<td>67%  €945</td>
</tr>
<tr>
<td>1.5</td>
<td>2.0</td>
<td>1.44</td>
<td>28%  €470</td>
</tr>
</tbody>
</table>

Compared with multi-stage centrifugal pumping water at 40 bar:

<table>
<thead>
<tr>
<th>Flow (m³/hr)</th>
<th>Energy used (kw)</th>
<th>Energy saving</th>
<th>Potential annual euro saving</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Centrifugal</td>
<td>Hydra-Cell</td>
<td></td>
</tr>
<tr>
<td>4.2</td>
<td>9.34</td>
<td>6.1</td>
<td>35%  €2,830</td>
</tr>
<tr>
<td>7.6</td>
<td>15.4</td>
<td>11.0</td>
<td>28%  €3,840</td>
</tr>
</tbody>
</table>

Simple robust design
- Designed and built for long service life.
- Simple maintenance with no special tool requirements.
- No critical tolerances to be aware of during maintenance.
- On-site repair possible, no costly requirement for removal and transportation to workshops.

Minimal filtration
- No mechanical seals or tight tolerances that need protection by fine filtration. Hydra-Cell® pumps can handle particles up to 500 µm, depending on model. Also liquids with non-dissolved solids up to 40%, depending on particle distribution.
- Unaffected by lapses in filtration, reducing costly pump repairs.
- Reduced filtration maintenance and management.
Ultimate Controllability for Metering and Dosing

Metering and dosing performance better than API675.

- **Steady state accuracy** better than +/- 1%

- **Linearity** (Pump shaft speed/flow rate relationship) better than +/- 3%

This is a measure of how well a set flow rate can be maintained.

- **Repeatability** better than +/- 3%

This is a measure of how accurate the flow rate can be controlled when varying the pump shaft rpm away from a set point and returning to that set point.

**Virtually pulse-less flow for accurate metering**

- Pulsation dampeners may not be required for most Hydra-Cell® pumps, thus reducing the risk of pipe strain.
- More accurate control of flow rate and efficient use of chemicals.
- Significantly less inlet acceleration head issues than traditional single diaphragm metering pumps, especially with viscous liquids.

Pipe line cleaning 90°C water UK Refinery
Hydra-Cell® Principles of Operation - Wobble Plate

Wobble Plate Models

1. Drive Shaft
2. Tapered Roller Bearings
3. Fixed-angle Cam/Wobble Plate
4. Hydraulic Cells (Patented)
5. Diaphragms
6. Inlet Valve Assembly
7. Discharge Valve Assembly
8. C62 Pressure Regulating Valve

Reliable, Efficient Pumping Action

The drive shaft (1) is rigidly held in the pump housing by a large tapered roller bearing (2) at the rear of the shaft and a smaller bearing at the front of the shaft. Set between another pair of large bearings is a fixed-angle cam or Wobble Plate (3).

As the drive shaft turns, the swash plate moves, oscillating forward and back (converting axial motion into linear motion). The complete pumping mechanism is submerged in a lubricating oil bath.

The hydraulic cell (4) is moved sequentially by the Wobble plate and filled with oil on their rearward stroke. A ball check valve in the bottom of the piston ensures that the cell remains full of oil on its forward stroke.

The oil held in the Hydra-Cell balances the back side of the diaphragms (5) and causes the diaphragms to flex forward and back as the Wobble plate moves. This provides the pumping action.

To provide long trouble-free diaphragm life, Hydra-Cell hydraulically balances the diaphragm over the complete pressure range of the pump. The diaphragm faces only a 0.21 bar pressure differential regardless of the pressure at which liquid is being delivered - up to 172 bar on standard Hydra-Cell models and Hydra-Cell metering pumps.

Hydra-Cell Wobble plate pumps can have up to five diaphragms, and each diaphragm has its own pumping chamber that contains an inlet and discharge self-aligning spring loaded check valve assembly (6). As the diaphragms move back, liquid enters the pump through a common inlet and passes through one of the inlet check valves. On the forward stroke, the diaphragm forces the liquid out the discharge check valve (7) and through the manifold common outlet. Equally spaced from one another, the diaphragms operate sequentially to provide consistent, low-pulse flow.

A Hydra-Cell C62 pressure regulating valve (8) is typically installed on the discharge side of the pump to regulate the pressure of downstream process or equipment.
Hydra-Cell® Principles of Operation - Crankshaft

Crank-shaft Models

1. Drive Shaft
2. Precision Ball Bearings
3. Connecting Rods
4. Hydraulic Cells (Patented)
5. Diaphragms
6. Inlet Valve Assembly
7. Discharge Valve Assembly
8. C46 Pressure Regulating Valve (In-line)

Reliable, Efficient Pumping Action

The drive shaft (1) is supported in position by two precision ball bearings (2) positioned at either end of the shaft. Located between these bearings are either one or three cam shaft lobes with connecting rods (3) that are hardened, precision ground, and polished. Maintaining a high level of quality on the cam lobes and connecting rod surfaces ensures proper lubrication and reduced operating temperatures in the hydraulic end of the pump.

As the drive shaft turns, each cam actuates the attached connecting rod that is pinned into position at the end of each hydraulic piston. This action moves the piston forward and backward, converting the axial motion into linear pumping motion. The complete pumping mechanism is submerged in a lubricating oil bath.

Each piston contains a patented hydraulic cell (4) that is moved sequentially by the crank-shaft. The innovative and proprietary Hydra-Cell maintains the precise balance of oil behind the diaphragm (5) regardless of the operating conditions of the pump. The oil in Hydra-Cell is pressurized on the forward stroke of the piston causing the diaphragm to flex, which drives the pumping action. The oil held in the Hydra-Cell balances the diaphragm against the liquid being pumped, maintaining no more than a 0.21 bar differential regardless of the pressure at which the liquid is being delivered - up to 172 bar on standard Hydra-Cell models and Hydra-Cell metering pumps.

Hydra-Cell crank-shaft pumps can have up to three diaphragms, and each diaphragm has its own pumping chamber that contains an inlet and discharge self-aligning spring loaded check valve assembly (6). As the diaphragms move back, liquid enters the pump through a common inlet and passes through one of the inlet check valves. On the forward stroke, the diaphragm forces the liquid out of the discharge check valve (7) and through the manifold common outlet. Equally spaced from one another, the diaphragms operate sequentially to provide consistent, low-pulse flow.

A Hydra-Cell C46 pressure regulating valve (8) is typically installed on the discharge side of the pump to regulate the pressure of downstream process or equipment.
**Hydra-Cell® Principles of Operation - T Series**

*API 674 option available*

Exclusive Seal-less Diaphragm Design

- Seal-less design separates the power end from the process liquid end, eliminating leaks, hazards, and the expense associated with seals and packing
- Low NPSH requirements allow for operation with a vacuum condition on the suction - positive suction pressure is not necessary
- Can operate with a closed or blocked suction line and run dry indefinitely without damage, eliminating downtime and repair costs
- Unique diaphragm design handles more abrasives with less wear than gear, screw or plunger pumps
- Hydraulically balanced diaphragms to handle high pressures with low stress
- Provides low-pulse, linear flow due to its multiple diaphragm design
- Lower energy costs than centrifugal pumps and other pump technologies
- Rugged construction for long life with minimal maintenance
- Compact design and double-ended shaft provides a variety of installation options
- Hydra-Cell T-Series pumps can be configured to meet API 674 standards – consult factory for details

*Hydra-Cell T80 Series pumps received a “Spotlight on New Technology” award from the Offshore Technology Conference.*
<table>
<thead>
<tr>
<th>Traditional Metering Pump Disadvantages</th>
<th>Hydra-Cell® Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use manual stroke adjusters or expensive actuators to control flow, which can result in pumping inaccuracies, lost motion, operator error, and a greater chance of leakage.</td>
<td>• Utilising Hydra-Cell’s unique hydraulic replenishment system, this gives constant diaphragm displacement and compression ratio ensuring consistent flow rate.</td>
</tr>
<tr>
<td>• Require expensive pulsation dampeners to minimize pulsations.</td>
<td>• Multiple-diaphragm design provides virtually pulse-free flow, so expensive pulsation dampeners, in most cases, may not be required.</td>
</tr>
<tr>
<td>• May only offer PTFE diaphragms, requiring frequent replacement due to stress and poor elastomeric memory.</td>
<td>• Available with a wide choice of cost-effective, elastomeric diaphragm materials.</td>
</tr>
<tr>
<td>• Large footprint to achieve required maximum flow and pressure.</td>
<td>• Can meet the same flow and pressure requirements with a much smaller footprint, saving space and costs.</td>
</tr>
<tr>
<td>• Different plunger and liquid end sizes needed to accommodate changes in operating pressures.</td>
<td>• Operates over a wide range of pressures without changes to the plunger or liquid end size.</td>
</tr>
<tr>
<td>• Integral gearing (necessary to prevent cross-contamination of actuating oil) is difficult and expensive to maintain.</td>
<td>• The simplicity of design means lower parts and maintenance costs. • Separate gearbox prevents cross-contamination of the actuating oil.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Gear Pump Disadvantages</th>
<th>Hydra-Cell® Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Mechanical seals and packing require maintenance, and replacement or adjustment.</td>
<td>• The seal-less design of Hydra-Cell® means that there are no seals or packing to leak or replace.</td>
</tr>
<tr>
<td>• Does not tolerate thin/non-lubricating liquids, and does not handle solids, abrasives or particulates well.</td>
<td>• Seal-less pumping chamber and spring-loaded, unique spring-loaded check valves can pump solids, abrasive fillers and particulates while handling liquids thick or thin.</td>
</tr>
<tr>
<td>• Designed for operating at low speeds and low pressure ratings. Low volumetric efficiency.</td>
<td>• Operates at low-to-high speeds and at higher pressures with higher volumetric efficiency.</td>
</tr>
<tr>
<td>• Component wear reduces accuracy and efficiency.</td>
<td>• No internal gears to wear so there is less maintenance and spare part replacement. • Accuracy and efficiency are more stable.</td>
</tr>
<tr>
<td>• Bearings &amp; bushes run in the pumped liquid.</td>
<td>• No bearings in the pumped liquid.</td>
</tr>
<tr>
<td>• Unbalanced - overhung load on the shaft bearing.</td>
<td>• Hydraulically balanced design so there is no overhung load.</td>
</tr>
<tr>
<td>• Fixed end clearances.</td>
<td>• Design does not rely on clearances.</td>
</tr>
<tr>
<td>• Efficiency drops over 103 bar.</td>
<td>• Efficiency remains relatively constant over its range of operating pressures.</td>
</tr>
<tr>
<td>• The ‘meshing’ action of the gear pump imparts a high-shear to the liquid</td>
<td>• The gentle, low-shear pumping action of the Hydra-Cell pump keeps the liquid in a more stable state for greater predictability and a more constant process.</td>
</tr>
</tbody>
</table>
### Magnetic Drive Pump Disadvantages vs. Hydra-Cell® Advantages

<table>
<thead>
<tr>
<th>Magnetic Drive Pump Disadvantages</th>
<th>Hydra-Cell® Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cannot run dry without damage to the pump.</td>
<td>• Seal-less design enables Hydra-Cell® to run dry without damage, indefinitely.</td>
</tr>
<tr>
<td>• Does not handle iron or scale particles well.</td>
<td>• Seal-less pumping chamber and spring-loaded check valves can handle particulates.</td>
</tr>
<tr>
<td>• Requires monitoring to ensure liquid flow.</td>
<td>• Ensures proper liquid flow without monitoring.</td>
</tr>
<tr>
<td>• Designed to pump clean, low-viscosity liquids.</td>
<td>• Seal-less pumping chamber and spring-loaded check valves can handle particulates and abrasive fillers.</td>
</tr>
<tr>
<td>• Higher power requirements and energy costs.</td>
<td>• Low-shear pumping action handles higher viscosity liquids.</td>
</tr>
<tr>
<td>• Can have a long horizontal footprint with higher acquisition and replacement costs.</td>
<td>• Smaller footprint compared to some magnetic drive pumps.</td>
</tr>
</tbody>
</table>

### Plunger Pump Disadvantages vs. Hydra-Cell® Advantages

<table>
<thead>
<tr>
<th>Plunger Pump Disadvantages</th>
<th>Hydra-Cell® Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cannot run dry without damage to the pump.</td>
<td>• Seal-less design enables the pump to run dry without damage, indefinitely.</td>
</tr>
<tr>
<td>• Requires fine filtration to protect dynamic seals.</td>
<td>• No dynamic seals to protect. No need for fine filtration to protect the pump. Recycled liquids and liquids containing particle can be pumped reliably.</td>
</tr>
<tr>
<td>• Liquids such as NGL's or Salt Water and corrosive or hot liquids can damage packing and seals.</td>
<td>• No dynamic seals, so can handle these liquids reliably.</td>
</tr>
<tr>
<td>• All dynamic seals are designed to leak resulting in crank oil contamination by process liquid and frequent oil changes.</td>
<td>• Crank oil and process liquid are completely separated resulting in significantly low frequency of oil change.</td>
</tr>
<tr>
<td>• The reciprocating action of the plunger pump imparts a high-shear to the liquid</td>
<td>• The gentle, low-shear pumping action of the Hydra-Cell pump keeps the liquid in a more stable state for greater predictability and a more constant process.</td>
</tr>
</tbody>
</table>

### Peristaltic Pump Disadvantages vs. Hydra-Cell® Advantages

<table>
<thead>
<tr>
<th>Peristaltic Pump Disadvantages</th>
<th>Hydra-Cell® Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Pulsing flow on discharge. Pulsation dampers required.</td>
<td>• Multiple diaphragm pump head ensures smooth discharge flow. Pulsation dampers not required on the majority of applications.</td>
</tr>
<tr>
<td>• Pump tube operates under stress leading to a consumable replacement part.</td>
<td>• Diaphragms operating in hydraulic balance under no stress leading to long life.</td>
</tr>
</tbody>
</table>
Manifolds

Manifolds for Hydra-Cell pumps are available in a variety of materials to suit your process application. They are easy to replace and interchangeable to accommodate different liquids processed by the same pump. Special manifolds with a 2:1 dosing ratio are also available. (Consult factory.)

Non-metallic Pump Heads

Non-metallic pump heads are often used when a corrosive or aggressive liquid is being processed at lower pressures.
- Polypropylene
- PVDF

Metallic Pump Heads

Metallic pump heads can handle higher operating pressures. Hastelloy CW12MW or Stainless Steel is also selected for corrosion resistance and other properties.
- Brass
- Bronze
- Cast Iron (Nickel-plated)
- Duplex Alloy 2205
- Super Duplex Alloy 2507
- Hastelloy CW12MW
- 304 Stainless Steel
- 316L Stainless Steel

Diaphragms and O-rings

Diaphragms and corresponding o-rings are available in several elastomeric materials.
- Aflas (used with PTFE O-ring)
- Butyl
- Buna-N
- EPDM (requires EPDM-compatible oil)
- FFKM
- FKM
- Neoprene
- PTFE

As part of our “Mass Customisation” philosophy, every Hydra-Cell pump is built with manifolds, elastomeric materials, and valve assemblies using construction materials specified by the customer. Hydra-Cell distributors and factory representatives are readily available to assist customers in selecting the materials best suited to the process application. (The range of material choices depends on each pump model – for example, models designed to operate at higher pressures are available with metallic pump heads only.)
Valve Materials

Hydra-Cell valve assemblies (seats, valves, springs, and retainers) are available in a variety of materials to suit your process application.

Valve Seats
- Ceramic
- Hastelloy CW12MW
- Nitronic 50
- Tungsten Carbide
- 17-4 PH Stainless Steel
- 316L Stainless Steel

Valves
- Ceramic
- Hastelloy CW12MW
- Nitronic 50
- Tungsten Carbide
- 17-4 PH Stainless Steel

Valve Springs
- Elgiloy (Exceeds SST grade 316L)
- Hastelloy CW12MW
- 17-7 PH Stainless Steel
- 316L Stainless Steel

Valve Spring Retainers
- Celcon
- Hastelloy CW12MW
- Nylon (Zytel)
- Polypropylene
- PVDF
- 17-7 PH Stainless Steel

Registered trademarks of materials:

- Aflas®: Asahi Glass Co., Ltd.
- Celcon®: Celanese Company
- Elgiloy®: Elgiloy Limited Partnership
- Kynar® (PVDF): Arkema, Inc.
- Mesamoll®: Lanxess Deutschland GmbH
- Nitronic® 50: AK Steel Corporation
- Viton® (FKM): DuPont Performance Elastomers, LLC
Hydra-Cell® Flow Capacities and Pressure Ratings

G, T and Q Series Seal-less Pumps

The graph above displays the maximum flow capacity at a given pressure for each model series. The table below lists the maximum flow capacity and maximum pressure capability of each model series.

<table>
<thead>
<tr>
<th>Model</th>
<th>Maximum Capacity l/min</th>
<th>Maximum Discharge Pressure bar</th>
<th>Maximum Operating Temperature °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>G20</td>
<td>3.8</td>
<td>24</td>
<td>103</td>
</tr>
<tr>
<td>G03</td>
<td>11.7</td>
<td>24</td>
<td>103</td>
</tr>
<tr>
<td>G04</td>
<td>11.2</td>
<td>N/A</td>
<td>200</td>
</tr>
<tr>
<td>G10</td>
<td>33.4</td>
<td>24</td>
<td>103</td>
</tr>
<tr>
<td>G12</td>
<td>33.4</td>
<td>N/A</td>
<td>103</td>
</tr>
<tr>
<td>G15/17</td>
<td>58.7</td>
<td>N/A</td>
<td>172</td>
</tr>
<tr>
<td>G25</td>
<td>75.9</td>
<td>24</td>
<td>69</td>
</tr>
<tr>
<td>G35</td>
<td>138</td>
<td>N/A</td>
<td>103</td>
</tr>
<tr>
<td>G66</td>
<td>248</td>
<td>17</td>
<td>48</td>
</tr>
<tr>
<td>T100S</td>
<td>98</td>
<td>N/A</td>
<td>345</td>
</tr>
<tr>
<td>T100M</td>
<td>144</td>
<td>N/A</td>
<td>241</td>
</tr>
<tr>
<td>T100K</td>
<td>170</td>
<td>N/A</td>
<td>207</td>
</tr>
<tr>
<td>T100H</td>
<td>259</td>
<td>N/A</td>
<td>145</td>
</tr>
<tr>
<td>T100F</td>
<td>290</td>
<td>N/A</td>
<td>128</td>
</tr>
<tr>
<td>T100E</td>
<td>366</td>
<td>N/A</td>
<td>103</td>
</tr>
<tr>
<td>Q155E</td>
<td>595</td>
<td>N/A</td>
<td>103</td>
</tr>
<tr>
<td>Q155F</td>
<td>490</td>
<td>N/A</td>
<td>127</td>
</tr>
<tr>
<td>Q155H</td>
<td>421</td>
<td>N/A</td>
<td>144</td>
</tr>
<tr>
<td>Q155K</td>
<td>295</td>
<td>N/A</td>
<td>207</td>
</tr>
<tr>
<td>Q155M</td>
<td>253</td>
<td>N/A</td>
<td>241</td>
</tr>
</tbody>
</table>

Please Note: Some models do not achieve maximum flow at maximum pressure. Refer to the individual model specifications in this section for precise flow and pressure capabilities by specific pump configuration.

1 24 bar maximum with PVDF (Kynar®) liquid end; 17 bar maximum with Polypropylene liquid end.
2 Consult factory for correct component selection for temperatures from 160°F (71°C) to 250°F (121°C).
### Hydra-Cell® Metering & Dosing Pumps – ATEX / Explosive Areas

#### Flow Capacities and Pressure Ratings

![Graph showing flow capacities and pressure ratings](image)

<table>
<thead>
<tr>
<th>Model</th>
<th>Maximum Capacity l/hr</th>
<th>Maximum Discharge Pressure bar</th>
<th>Maximum Operating Temperature °C</th>
<th>Maximum Inlet Pressure bar</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Non-Metallic</td>
<td>Metallic</td>
<td>Non-Metallic</td>
</tr>
<tr>
<td>MT8</td>
<td>30</td>
<td>N/A</td>
<td>241</td>
<td>N/A</td>
</tr>
<tr>
<td>P200</td>
<td>102</td>
<td>24</td>
<td>103</td>
<td>60°</td>
</tr>
<tr>
<td>P300</td>
<td>95</td>
<td>N/A</td>
<td>172</td>
<td>N/A</td>
</tr>
<tr>
<td>P400</td>
<td>305</td>
<td>24</td>
<td>69</td>
<td>60°</td>
</tr>
<tr>
<td>G13 - M2H</td>
<td>462</td>
<td>24</td>
<td>103</td>
<td>60°</td>
</tr>
<tr>
<td>G13 - M2M</td>
<td>462</td>
<td>24</td>
<td>60</td>
<td>60°</td>
</tr>
<tr>
<td>G13 - M4L</td>
<td>230</td>
<td>24</td>
<td>20</td>
<td>60°</td>
</tr>
<tr>
<td>G13 - M2L</td>
<td>462</td>
<td>24</td>
<td>20</td>
<td>60°</td>
</tr>
<tr>
<td>G04 - M4H</td>
<td>226</td>
<td>N/A</td>
<td>172</td>
<td>N/A</td>
</tr>
<tr>
<td>G04 - M2M</td>
<td>452</td>
<td>N/A</td>
<td>150</td>
<td>N/A</td>
</tr>
<tr>
<td>G10 - M4H</td>
<td>732</td>
<td>24</td>
<td>103</td>
<td>60°</td>
</tr>
<tr>
<td>G10 - M2M</td>
<td>1470</td>
<td>24</td>
<td>50</td>
<td>60°</td>
</tr>
<tr>
<td>G10 - M4L</td>
<td>732</td>
<td>20</td>
<td>20</td>
<td>60°</td>
</tr>
<tr>
<td>G10 - M2L</td>
<td>1470</td>
<td>20</td>
<td>20</td>
<td>60°</td>
</tr>
<tr>
<td>G25 - M4L</td>
<td>2600</td>
<td>20</td>
<td>20</td>
<td>60°</td>
</tr>
<tr>
<td>G25 - M4M</td>
<td>2600</td>
<td>24</td>
<td>60</td>
<td>60°</td>
</tr>
<tr>
<td>G35 - M2L</td>
<td>6360</td>
<td>N/A</td>
<td>10</td>
<td>N/A</td>
</tr>
<tr>
<td>G35 - M4L</td>
<td>4800</td>
<td>N/A</td>
<td>30</td>
<td>N/A</td>
</tr>
</tbody>
</table>

1. 24 bar maximum with PVDF (Kynar®) liquid end; 17 bar maximum with Polypropylene liquid end.
2. Consult factory for correct component selection for temperatures from 160°F (71°C) to 250°F (121°C).
### Hydra-Cell® Metering & Dosing Pumps – Electronic Control

#### Flow Capacities and Pressure Ratings

Below is a table summarizing the flow capacities and pressure ratings for Hydra-Cell® pumps. The table includes models, maximum capacity in litres per hour (l/hr), maximum discharge pressure in bar, maximum operating temperature in °C, and maximum inlet pressure in bar.

**Models:** MT8, P100, P200, P300, P400, P500, P600, G03, G04, G10, G15, G25, G35

**Maximum Capacity (l/hr):**

- MT8: 30
- P100: 85
- P200: 255
- P300: 257
- P400: 766
- P500: 1244
- P600: 2808
- G03: 660
- G04: 660
- G10: 1800
- G15: 2940
- G25: 4560
- G35: 8280

**Maximum Discharge Pressure (bar):**

- MT8: N/A
- P100: 24
- P200: 24
- P300: 24
- P400: 24
- P500: 24
- P600: 24
- G03: 24
- G04: 24
- G10: 24
- G15: 24
- G25: 24
- G35: 24

**Maximum Operating Temperature (°C):**

- MT8: 121°
- P100: 121°
- P200: 121°
- P300: 121°
- P400: 121°
- P500: 121°
- P600: 121°
- G03: 121°
- G04: 121°
- G10: 121°
- G15: 121°
- G25: 121°
- G35: 121°

**Maximum Inlet Pressure (bar):**

- MT8: N/A
- P100: 17
- P200: 17
- P300: 17
- P400: 17
- P500: 17
- P600: 17
- G03: 17
- G04: 17
- G10: 17
- G15: 17
- G25: 17
- G35: 17

---

1. 24 bar maximum with PVDF (Kynar®) liquid end; 17 bar maximum with Polypropylene liquid end.
2. Consult factory for correct component selection for temperatures from 160°F (71°C) to 250°F (121°C).
WANNER ENGINEERING - WORLD HEADQUARTERS & MANUFACTURING
Minneapolis USA
t: (612) 332-5681
e: sales@wannereng.com

WANNER PUMPS
Shanghai CHINA
t: +86-21-6876 3700
e: sales@wannerpumps.com

WANNER INTERNATIONAL
Hampshire UK
t: +44 (0) 1252 816847
e: sales@wannerint.com

WANNER PUMPS
Kowloon HONG KONG
t: +852 3428 6534
e: sales@wannerpumps.com

www.hydra-cell.eu